Ball Aerospace Commentary

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Risk management must evolve to using cost reserves for solving problems instead of making improvements

- **Be very careful imposing unfunded risk reduction efforts on cost-capped missions**
- **Reserves allocated too liberally to early risk-reduction work will short the account for the recovery of real problems during integration and test**
  - Most of the *total* reserves should still be available at the start of AI&T, not merely 25% of the cost-to-go
- **Don't ignore the risk level that was accepted in the proposal's review process for selection**
  - Risk management must recognize the inherent limitations imposed by cost

Rigorous change control is key to controlling cost growth

- **Recognize that changes in design from what was proposed will have a cost impact**
  - Seemingly small changes can have major, unforeseen consequences
  - Make sure to evaluate proposed changes from a systems perspective
- **Always ask "*Is this change necessary for mission success?*"**
- **Industry and managing institutions must *both* have the culture to support, and the judgment to know, when good enough is good enough**

External programmatic changes can combine to add costs and threaten program success

- **Post-selection changes to management, schedule, requirements, and margins**
  - SMD budgetary pressures can lead to mandated changes in cost profiles
  - Management changes can lead to differing center-specific requirements
- **Post-selection addition of review requirements**
  - Deep Impact had 63 non-proposed, and therefore non-funded, reviews in a two year period
  - This resulted from a shift in the risk tolerance from proposal to implementation
  - An *a priori* understanding of the full implication of changing ground rules can be very difficult, but can be key to program success

Recommendations to Consider

- **Find a way to put some flexibility into funded risk margins based on level of maturity, not simply an arbitrary percentage per calendar date**
  - Determine and appropriately fund an approach to cost reserve and risk management in a way that allows for added judgment to supplement the present algorithm of 'cost-to-go'
- **Split reserve pool in 2, with part held for dealing with real problems, not added risk mitigation**
- **Significantly increase Phase A/B duration and funding to solidify the programmatic baseline, particularly for new or immature technologies**
- **Enable more design reuse from mission-to-mission. Perhaps establish a standard "catalogue" of interplanetary components, subsystems, and/or buses**